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abundant volatile nitrosamines in mainstream smoke,  
and carcinogenic in experimental animals. [13]

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smoke of 17 commercial and experimental cigarettes and between 680 and 1770 nanograms in the un-aged sidestream smoke. The authors note that "[t]he nitrate content of tobacco appears to be a determining factor for the concentration of volatile nitrosamines in the smoke. Selective removal of these nitrosamines does occur with cellulose acetate filter tips but not with charcoal filter tips." [7]

1979 The U.S. Surgeon General's Report notes that the freshly generated smoke of three U.S. nonfilter cigarettes contained 13 to 65 nanograms of nitrosodimethylamine and that freshly generated sidestream smoke contains 10 to 40 times higher concentrations. [8]

1979 In two separate studies, Rinkus *et al.* (1979) and  
1980 Bartsch *et al.* (1980) found several cigarette smoke constituents to be mutagenic. Among those were nitrosodimethylamine. [9]

1980 Hoffmann, Chen and Hecht note that "most present-day commercial filter cigarettes are effectively reducing [volatile nitrosamines]." [10]

1982 The U.S. Surgeon General notes that, of the volatile nitrosamines, nitrosodimethylamine, along with nitrosopyrrolidine, occurs in the highest concentrations. Nitrosodimethylamine is listed as a "toxic and tumorigenic agent" in the gas phase of cigarette smoke. [11]

1982 The Third Annual Report on Carcinogens notes that "there is sufficient evidence for the carcinogenicity of DMNA in experimental animals." [12]

1985 The International Agency for Research on Cancer regards nitrosodimethylamine, one of the two most

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## References

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Nitrosodimethylamine  
(NDMA)

- 1937 Freund reported the hepatotoxic action of NDMA in describing the clinical and autopsy findings in two chemists accidentally poisoned with nitrosodimethylamine. [1]
- 1956 Magee and Barnes demonstrated that nearly all rats on a diet containing 50 ppm nitrosodimethylamine developed malignant liver tumors within less than a year. [2]
- 1960 Zak *et al.* induced lung tumors in rats by feeding and daily oral dosing of nitrosodimethylamine. [3]
- 1966 Serfontein and Hurter identify nitrosodimethylamine in cigarette smoke condensate of South African cigarettes. [4]
- 1971 Hoffmann and Vais reported 80 nanograms of nitrosodimethylamine in the unaged smoke of a nonfilter 85 millimeter U.S.-blended cigarette. [5]
- 1973 Hoffmann, Rathkamp and Liu report 84 nanograms of dimethylnitrosamine in the mainstream smoke of a non-filter U.S. blended cigarette. The authors report that filter tips reduce volatile nitrosamines, e.g NDMA, from 60 to 85%. [6]
- 1977 Brunneman, Yu and Hoffmann, using gas-liquid chromatography and mass spectrometry, quantitatively determined the level of nitrosodimethylamine in mainstream and sidestream smoke. They found between 1.7 and 97 nanograms of nitrosodimethylamine in the unaged mainstream

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